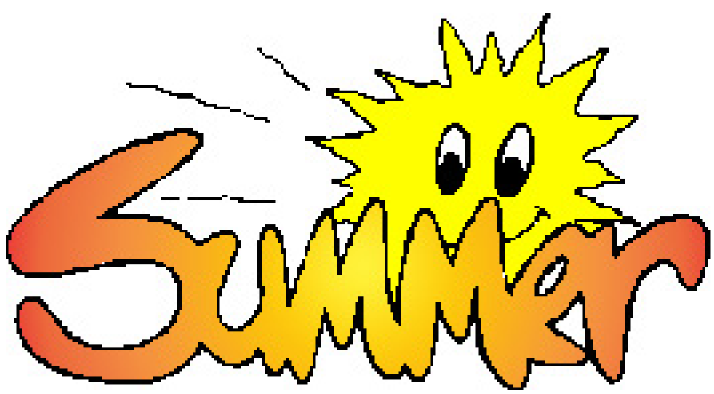
Summer 2005

RPM News

▲ Remedial Project Manager News ▲

"Communicating Navy Installation Restoration Program News and Information Among All Participants"

In This Issue



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To submit your article for upcoming issues of RPM News, provide a complete current and/or updated article from a previous story. A complete article includes text, photographs, captions, etc. Multiple articles may be submitted by one author, but send them as separate files. Tentative deadlines for upcoming issues of RPM News:

Fall 2005	**5 August**
Winter 2005	**4 November**
Spring 2006	**6 January**

RPM NEWS

Remedial Project Manager News

Published By
NFESC

NAVFAC

Using Appropriated Funds

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Active Golf Course Transfer

NAS Cecil Field

Project Summary

An environmental assessment for the condition of the property at the former Naval Air Station (NAS) Cecil Field revealed that surface soils at the active golf course (Figures 1 through 3) contained pesticide and inorganic contaminants in excess of Florida Department of Environmental Protection (FDEP) and United States Environmental Protection Agency (USEPA) action levels. The USEPA considered making the golf course a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, which would have resulted in a costly investigation and cleanup. The transfer of the property would have most likely been delayed for years due to the potential CERCLA designation. However, by working closely with USEPA risk assessors, the Base Realignment and Closure (BRAC) Cleanup Team (BCT) was able to demonstrate that current soil levels fell within the USEPA risk range, thus eliminating any CERCLA concerns.

Figure 1. Golf course layout and site limits.

FDEP took the position that because the property was to remain a golf course at which additional pesticides would be applied in the future, cleanup would not be required as long as the future use of the property was legally restricted to golf course use only. The Navy desired not to impose any land use controls (LUCs) on the property because other golf courses sold throughout the nation were not required to restrict future use of the property.

The Navy proposed that the golf course be transferred to the City of Jacksonville (COJ) restriction-free and that the COJ then enter into a Restrictive Covenant (RC) with FDEP that would restrict future use of the property to golf course use only. The BCT concurred with this proposal and proved to the USEPA, FDEP, and the COJ that the concept was valid. On completion of the Finding of Suitability to Transfer (FOST), the property was deeded to the COJ restriction free. Concurrently, FDEP and the COJ executed the RC, which was recorded along with the deed.

Regulatory Requirements/Community Involvement

The investigation of an active golf course quickly became high profile with potentially far reaching impacts. Presentations to the NAS Cecil Field Restoration Advisory Board (RAB) identifying the actions being conducted regarding the investigation and future use scenarios of the golf course were made at various times throughout this dynamic process. Once it was identified that the golf course was not considered a CERCLA site, public notification was not required; however, status updates were presented during the quarterly BCT meetings and notification of the transfer of the property was publicized in the local newspaper.

Figure 2. Active golf course.

Cost Avoidance Measures

By eliminating extensive investigation and potentially expensive remediation, an estimated cost of approximately $2,000,000 and a potential three-year delay in the transfer of the site were avoided. Additionally, by developing the RC approach, the Navy was able to meet its desire to transfer the property without LUCs while satisfying FDEP’s desire to restrict future use of the property to golf course use only. Enabling the property to be transferred without LUCs and using the restrictive covenant to assure protection eliminated the need for the Navy to conduct inspections and avoided the cost associated with LUC implementation at this site. It is estimated that by eliminating the LUC administrative burden of inspecting and reporting, the Navy’s cost avoidance will be an additional $100,000.

Figure 3. Stream between fairways.

Project Successes

The teaming concept to reach a mutually beneficial end was identified by implementing the concept of a restrictive covenant. Without teaming and the strong trust established between the teaming members, such a covenant between the State and the city would not be feasible. By avoiding the need for this property to become a CERCLA site, significant time and cost avoidance were identified and a potentially precedent-setting designation was avoided.

Lessons Learned

- *Environmental sampling of an active golf course is not advisable. If environmental investigations are being conducted adjacent to an active golf course, it is important to know the boundaries of the golf course as not to inadvertently sample within those boundaries.*
- *Working with EPA risk assessors can help identify ways to prevent marginally impacted sites from entering into the CERCLA program.*
- *Implementation of restrictive covenants between future property owners and the regulatory agency is an effective way to restrict future uses of a property without requiring the Navy to implement long-term land use controls and inspections.*

Points of Contact

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Navy Completes Environmental Cleanup of Naval Magazine Indian Island

Naval Magazine Indian Island, WA, Landfill cap surface with native grass and wildflowers.

On June 14, 2005 the U.S. Environmental Protection Agency (EPA) in collaboration with the Washington State Department of Ecology and the U.S. Navy, determined that the cleanup actions at Naval Magazine Indian Island at Port Hadlock have been effective in protecting human health and the environment. On-site monitoring has shown that cleanup goals for the site have been met. Long-term monitoring and land use controls will ensure that the cleanup continues to be protective.

Naval Magazine Indian Island is located in Port Hadlock, Washington. It covers about 2,700 acres. The Navy uses the island to store and handle munitions. The island is home for a diverse wildlife population and several threatened or endangered species. Island beaches are used for commercial and recreational shellfish harvesting. After many years of disposing toxic wastes at two landfill areas on the island, the Navy found high levels of heavy metals, polychlorinated biphenyls (PCBs), pesticides, and other toxic substances in soil, groundwater, and other toxic substances in soil, groundwater, sediments, and shellfish.

In 1991, the Navy and the Washington State Department of Ecology began planning cleanup of the 3.7-acre landfill located on the western shore of Puget Sound near Port Hadlock on the site at the northern tip of Indian Island. Naval Magazine Indian Island (Detachment Port Hadlock) was placed on the NPL in 1994 due to historic contamination that included a landfill that operated from the 1940s through the 1970s. The landfill received residential and industrial wastes, including paint and petroleum products, demolition debris, and ash from an incinerator that operated adjacent to the landfill. Environmental investigations found trace metals, organics, and petroleum hydrocarbons in shellfish near the landfill. The Navy began cleanup activities at the site in 1996, which included:

- *Construction of a low permeability cap over the landfill.*
- *Construction of a shoreline protection system along the landfill perimeter and shoreline.*
- *Restoration of nearby areas; regrading hillsides and replanting the area with native vegetation to control erosion.*
- *Mitigation measures to protect Native American artifacts.*
- *Implementation of a temporary prohibition on shellfish harvesting and restrictions on residential use and farming.*
- *Regular inspection and maintenance of the landfill cap and the shoreline protection system.*
- *Regular monitoring of the quality of groundwater, sediment, and shellfish at and near the landfill.*

The EPA and State, as part of the remedial action process, determined that the Navy's actions would protect human health and the environment. Continued maintenance and monitoring will ensure that the cleanup for this site will remain effective.

Indian Island is the first Navy site totally deleted from the NPL. Partially deletions have occurred at Treasure Island (CA) and Whidbey Island (WA). In addition to Port Hadlock, the U.S. Navy has eight sites on the NPL list in the Puget Sound area and has been actively investigating and cleaning up these sites for more than two decades, investing more than $150 million in the effort. Many of these sites are now considered to be safe for public use.

NAS Whidbey Island. The Navy began remediation efforts at the 45-acre NAS Whidbey Island municipal waste landfill in 1995. In 1992, the landfill was closed due to groundwater contamination. The Navy constructed a multiple layer cap over the landfill to prevent further infiltration of rainfall and potential exposure to contaminants. The construction of the cap consisted of several layers, including structural fill, a support layer, gas collection layer, secondary liner, primary liner, drainage layer, and soil cover. The installation of the cap and a groundwater collection and treatment system has significantly reduced groundwater contaminant levels. The Navy also conducted cleanup of a liquid waste disposal pit northwest of the landfill cap. The Navy removed and properly disposed of approximately 166.5 pounds of the solvent trichloroethylene (TCE) from the disposal pit. The Navy continues to operate the groundwater treatment system and conduct regular monitoring of the groundwater to ensure the cleanup goals are being met.

Some other major cleanup projects the Navy has completed include offshore sediment cleanup at Bremerton Naval Complex, cleanup and installation of a recreational park at Jackson Park Housing Complex, and demolition and cleanup of a former plating shop at the Naval Undersea Warfare Center (NUWC) Keyport.

Bremerton Naval Complex. At the Bremerton Naval Complex, the Navy has completed cleanup both onshore and offshore. Offshore, the Navy planned to deepen berths for homeporting aircraft carriers and also needed to clean up contaminated sediment. The Navy combined these two projects and constructed the first underwater disposal pit, referred to as a confined aquatic disposal (CAD) pit, for contaminated sediments in Puget Sound. The CAD pit, which is located approximately 30 feet deep and 300 feet offshore, was built in 2001 and is being continuously monitored for its effectiveness. The pit is nearly 9 acres in size and holds approximately 400,000 cubic yards of contaminated sediment. The cap itself is 5 feet thick. The project was designed to protect Chinook salmon listed under the Endangered Species Act (ESA). The CAD pit area is used by the public and the Suquamish Tribe for fishing.

Jackson Park Family Housing Complex. A portion of this former Naval Ammunition Depot had chemical contamination that posed a risk to local residents. The Navy cleaned up the site and turned it into a recreation area for the Jackson Park Family Housing Complex and Naval Hospital Bremerton. This included screening the top 1-foot layer of soil to remove any historic munitions, replacing the soil, and adding a 1-foot soil cap over approximately 19 acres of the site. The Navy also improved the shoreline to prevent erosion and create habitat beneficial to the marine species. Once the soil cap was in place, the Navy installed a bike path, playground, softball field, and tennis, basketball, and volleyball courts. This work began in August 2000 and was completed in June 2002.

Naval Undersea Warfare Center (NUWC) Division, Keyport. One of the many cleanup tasks at NUWC Division, Keyport included demolishing a former plating facility and tanks used to hold fuel or dangerous waste from a former plating facility. Once the building was removed, the Navy excavated and properly disposed of the underlying soil contaminated with heavy metals. After cleanup, the area was paved and is now used as a parking lot.

Point of Contact

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NAVFAC Optimization Study of a Groundwater Remediation System for Perchlorate Removal

Naval Weapons Industrial Reserve Plant, McGregor, Texas

Introduction

Naval Facilities Engineering Command, Southern Division (NAVFAC SOUTHDIV) is taking a proactive approach to identifying opportunities for the optimization of remedy selection and remedial action operations at their sites. Over 56 optimization studies are underway or have been completed at various sites within NAVFAC SOUTHDIV. One study that was recently completed was an evaluation of existing remedial actions for the Area M Groundwater Remediation System at the Naval Weapons Industrial Reserve Plant (NWIRP) in McGregor, Texas. The objective of the optimization study was to assess the progress of the existing groundwater remedy in meeting remedial action objectives and to provide recommendations for ultimately reaching site closeout at an optimal life-cycle cost.

The optimization study was conducted through a review of site-related documents and data, meetings with the operator of the system, and a site tour. The specific tasks completed for the optimization study included:

- *Evaluation of operation and maintenance (O&M) cost reduction opportunities, including a review of the level of automation, operating procedures, and permit requirements.*
- *Documentation of optimization efforts completed to date to reduce life-cycle costs.*
- *Development of an exit strategy to allow the aboveground treatment to be terminated in the future, including an evaluation of source removal, in situ treatment methods, and a review of the remedial action objectives.*
- *Performance of a cost-benefit analysis to compare alternate approaches and to recommend an approach and implementation strategy.*

Project Background

NWIRP McGregor is located approximately 20 miles southwest of Waco, Texas. The facility was used for industrial activities including the manufacturing of weapons and solid-fuel rocket propulsion systems. These activities were conducted in a section of the plant referred to as Area M. The plant was first opened in 1942 and ultimately closed in 1995. In order to initiate property transfer, site investigation activities were conducted and groundwater was found to contain ammonium perchlorate (a component of rocket fuel) at concentrations ranging from non-detect up to 91,000 µg/L. A nearby surface water body, Tributary M, was also found to contain perchlorate at concentrations up to 5,600 µg/L on-site and 56 µg/L as far as 3 miles downstream of the site boundary. Perchlorate was not detected in any surface water samples at locations designated as a potential source of drinking water.

Figure 1. Fluidized Bed Reactor at NWIRP McGregor for Perchlorate Removal

A groundwater remedy consisting of passive biobarriers and a pump-and-treat system is currently operating to meet the remedial action objective of providing hydraulic containment to minimize seepage of the perchlorate plume into the nearby surface water body. Groundwater is pumped from a network of collection trenches to an ex situ biological reactor and treated groundwater is returned to the aquifer via infiltration or discharged to Tributary M under a Texas state discharge permit. The collection trenches are partially filled with organic matter such as cottonseed to promote in situ biodegradation and excess groundwater that is not treated within the trench is then pumped to a 400 gallon per minute (gpm) fluidized bed reactor (FBR) that uses acetic acid and nutrients to promote perchlorate removal (see Figure 1). In addition, several areas of perchlorate-contaminated soil have been delineated and the contaminated soil excavated and treated. Treatment has been performed on-site using biological treatment in various soil cells within Area M where microbes and nutrients were mixed with the contaminated soil. These cells lie to the north and west of interceptor trenches.

Figure 2 shows the primary components of the Area M groundwater treatment system including a lift station, the FBR, a lagoon, and associated soil cells. The first step in the treatment process is the removal of water from the network of collection trenches by pumping out of a lift station into which all three collection trenches flow. Water is then pumped out of the lift station to a 10 million gallon lagoon (Lagoon A) for storage or to the FBR for treatment. The level in the lift station must be maintained below a certain setpoint (depth to water of 8.2 feet or greater) to prevent seepage of contaminated groundwater from discharging into Tributary M. Treated water from the FBR is then discharged to Soil Cells A, B and C for effluent holding either in batch mode or in continuous mode and from there discharges to the outfall in Tributary M.

Figure 2. Aerial Photograph of Area M Groundwater Treatment System

Optimization Review

The focus of the optimization study was on the groundwater remedy since perchlorate-impacted soil that exceeded the industrial cleanup goal of 82 mg/kg had been addressed and any soil exceeding impact to groundwater criteria will be addressed by further plume treatment.

It was determined that the FBR system functioned very well and consistently achieved analytical results of non-detect for perchlorate in the treated effluent. Based on daily water level readings, the system has also effectively contained the plume by maintaining a groundwater level of less than 8.2 ft at all times to prevent the discharge of contaminated groundwater from Area M into Tributary M. After the first year of operation, there were no exceedances of the permit limits including a daily average of 0.006 mg/L and a daily maximum of 0.013 mg/L for perchlorate from the FBR system. However, it was noted that the annual analytical costs were very high because of the permit requirements. Depending on the amount of water that is treated, the number of samples analyzed for perchlorate could range from 50 to 75 per month. Other permit sampling requirements included biological oxygen demand (BOD), total organic carbon (TOC), nitrogen, phosphorus, and total dissolved solids.

Since the FBR system has been in operation, approximately 1,373 kg of perchlorate has been removed from the groundwater. The data collected indicates that the influent concentrations to the FBR system have remained relatively high and that the cumulative mass removed is continuing to increase at a steady rate. Based on a review of the data, it does not appear that the treatment system will be able to reduce concentrations within the plume area to levels below the cleanup goal of 4 µg/L within a reasonable time frame. The treatment system is well suited for preventing groundwater seepage into Tributary M; however, due to low permeability of the aquifer and low production of the trenches, the treatment system is not likely to achieve the cleanup goals throughout the plume cost-effectively.

It was noted that there have been several significant optimization measures performed thus far aimed at reducing overall project costs, while maintaining protectiveness to human health and the environment. Examples of these efforts include:

- *Innovative on-site anaerobic landfarming of perchlorate-contaminated soil using citric acid, buffer, and nutrients, reducing the perchlorate concentrations from 500 mg/kg to less than 0.1 mg/kg in six to eight weeks.*
- *The use of in situ biological treatment trenches backfilled with edible-oil-saturated wood chips, compost, mushroom compost and gravel to act as biobarriers to eliminate the need for hydraulic control at down-gradient off-site locations.*
- *In situ treatment with bio-bores to inject cottonseed meal, perchlorate-reducing microbes (PRMs), and sodium acetate addition using an air rotary rig that achieved 20 bioborings per day.*
- *Replacing the ion exchange system that was originally installed at this facility with the FBR to reduce groundwater treatment costs.*

Optimization Strategies

The study resulted in the development of several potential strategies including optimization steps for the existing system, development of an exit strategy for pump-and-treat, and an economic analysis and comparison of potential remedial alternatives.

The existing remedial system was evaluated to determine if operating costs could be reduced, while continuing to meet the remedial action objectives of hydraulic containment and meeting the requirements of the discharge permit. It was found that the system in general is efficient and reliable, but the cost for operating labor and laboratory analysis appeared to be high due to several factors. A set of recommendations was developed to (1) increase the level of process controls and instrumentation to reduce labor requirements; (2) increase the flexibility in the management of water among the storage units to reduce the complexity of system operations; and (3) to renegotiate the discharge permit sampling requirements to reduce analytical costs. It was estimated that implementing these modifications would result in a one-time cost of $335,000 with a payback time of approximately 1.5 years. The 30-year net present value cost avoidance was estimated at $6,000,000. In addition to reducing cost, the modifications would improve system reliability, thus enhancing its ability to meet the remedial action objectives.

An exit strategy for the pump-and-treat system was developed along with several future remedial alternatives to be considered as follows:

1. *Baseline – Operate pump-and-treat with no changes from current operation.*
2. *Implement design modifications and operate pump-and-treat.*
3. *Implement design modifications, develop risk-based goals, install a treatment wall and operate P&T until the wall demonstrates that it is sufficiently effective to meet risk-based goals.*
4. *Implement design modifications, develop risk-based goals, install additional recovery trenches and operate P&T until risk-based goals are met.*

Two alternatives (Alternatives 3 and 4) were presented that would potentially expedite the shut down of the pump-and-treat system. For Alternatives 3 and 4, it was estimated that the pump-and-treat system would need to continue to operate for a period of four years and five years, respectively, before it can shut down; thus, implementing Alternative 2 would still be cost-effective. Both alternatives would require the development of risk-based criteria to determine what concentration of perchlorate in Area M groundwater can be allowed at the boundary to Tributary M. Alternative 3 entails the installation of an in situ treatment trench that would be installed just upgradient of the existing groundwater collection trench. Alternative 4 entails the installation of additional groundwater extraction trenches to aggressively clean up the site to a level sufficient to allow the pump-and-treat system to be shut down. Of these two alternatives, the installation of the in situ treatment wall (Alternative 3) is more implementable, has a lower capital investment, a quicker payback time on the investment, and a lower 30-year NPV cost. The capital, O&M, and 30-year NPV costs for each alternative is presented in Table 1, along with the break-even time for each as compared to either Alternative 1 or Alternative 2. The NPV costs versus time are shown graphically in Figure 3.

Table 1. Comparison of Groundwater Remedy Alternatives

Alternative Number	Capital Cost	30-Year NPV	30-Yr NPV Cost Avoidance		Payback Period, Years	
			Vs Alt 1	Vs Alt 2	Vs Alt 1	Vs Alt 2
1	$0	$14,478,591	NA	NA	NA	NA
2	$335,000	$8,483,651	41 %	NA	1.5	NA
3	$1,929,000	$5,666,726	61 %	33 %	7	14
4	$8,196,097	$9,826,216	32 %	-16 %	20	>30

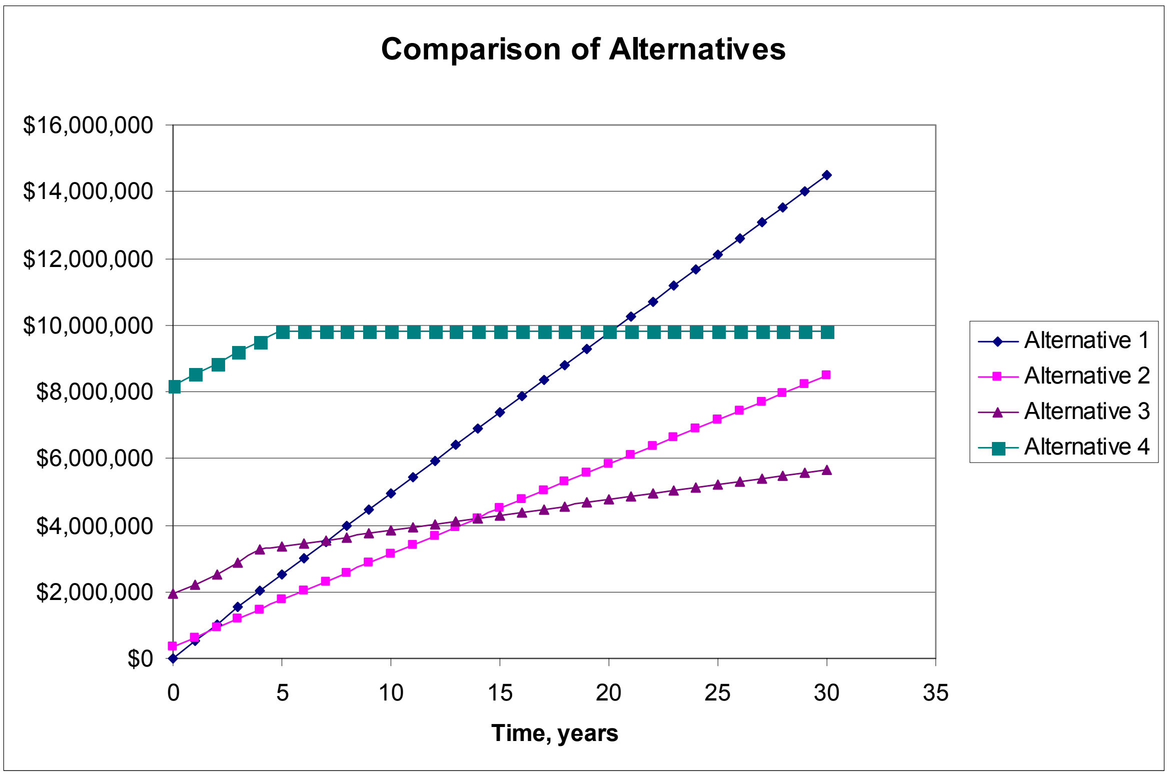

Figure 3. Comparison of Groundwater Remedy Alternatives

Conclusions

The optimization study recommended that modifications be made to the existing system that could result in a $335,000 capital expense and a payback time of approximately 1.5 years. It was also recommended that the alternative remedial approach of the in situ treatment wall (Alternative 3) be reconsidered in the future, which would result in an additional capital cost of $1,600,000 and a payback period of 14 years.

Point of Contact

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Site Prep Reduces Costs, Ups Effectiveness of Long-Term O&M at Landfill

At the former Naval Air Station (NAS) Moffett Field (Moffett), the Navy applied a three-part approach to preparing a capped landfill site for cost-effective long-term groundwater monitoring and operation and maintenance (O&M). The three-part approach consisted of site preparation work to: 1) control burrowing animals, 2) replace "problem" monitoring wells, and 3) develop long-term monitoring and maintenance plans. This approach ensures that human health and the environment are protected, while long-term monitoring and maintenance costs are minimized.

Background

The Site 1 Landfill is at the northernmost portion of Moffett at the end of the runway and is bounded on two sides by surface water. The landfill covers approximately 12 acres. It operated from 1965 until the late 1970s. Detailed records for the landfill were not maintained. Reportedly, it served as a sanitary landfill, receiving wastes such as cardboard, lawn cuttings, prunings, wood waste, and asbestos insulation wrapped in double-plastic bags. According to civilian and military personnel, the landfill also received refuse from maintenance and military operations such as scrap equipment, paint and paint thinners, solvents, lacquer, ash, asbestos, jet fuels, waste oil, fuel filters (containing fuel sludge, lead compounds, and rust), transformer oil, transformer filters, and sawdust contaminated with polychlorinated biphenyls (PCBs). A conservative estimate of the total refuse volume is 423,000 cubic yards.

The Record of Decision (1997) required consolidating the wastes from the nearby one-acre Site 2 Landfill into the Site 1 Landfill and constructing a multilayer cap over the Site 1 Landfill. The landfill was capped (bottom to top) with a 2-foot foundation layer, a 1-foot low-permeability clay layer, a geotextile biotic barrier, and a 1-foot vegetative soil cover. The cap was constructed between August and November 1997. Gas vents, a collection trench, a gas vent trench, landfill gas and groundwater monitoring wells, drainage ditches, road work, and a perimeter chain-link fence were completed in 1998.

Burrowing Animal Control a Great Success

Like other landfills in the San Francisco Bay area, the Site 1 Landfill is prone to invasion from burrowing animals, especially the California gray squirrel. In a landfill environment, these animals can burrow beneath or around the landfill cap and into the buried refuse. Consequently, the integrity of the cap could be compromised, and the animals could be exposed to contaminants and bring refuse to the surface.

Squirrels from nearby areas were crossing the fence and burrowing at the Site 1 Landfill.

Squirrels thrive at Moffett, including at the golf course and other areas adjacent to the Site 1 Landfill. The squirrels were crossing the perimeter fence and using the road berms, drainage areas/energy dissipaters, and vegetative cover, especially along the landfill slopes, as favorable habitats to establish colonies at the site. Raptor perches installed on the landfill surface in 2000 attracted birds of prey such as hawks, and limited squirrel activity on the landfill in the vicinity of the perches, but the perches were not a complete solution to the squirrel problem.

Numerous squirrel burrows have been filled since completion of cap-related construction in 1998, with burrow-filling maintenance increasing to a monthly frequency in 2001. During August 2001, approximately 40 squirrel burrows had to be filled as part of landfill maintenance. Geotextile fabric on the surface in 2001 showed that the squirrels were burrowing at least to the top of the low permeability clay layer.

To supplement the raptor perches and address the squirrel problem throughout the fenced landfill area, the Navy developed a plan to prevent the squirrels from establishing colonies on and near the landfill. The plan included: 1) elimination of established squirrel colonies on site 2) restriction of access to the site, and 3) elimination of favorable habitat areas on and near the landfill.

First, on-site squirrels were eliminated following a survey to ensure no burrowing owls were within the landfill area. Second, the perimeter, chain-link fence was lined with sheet metal or high-density polyethylene (HDPE) flashing from 6 inches below to 3 feet above grade. Because of the landfill's location at the end of the runway, the HDPE sheets were used on portions of the fence where metal sheets might interfere with runway radio transmissions. A 2" by 4" wood brace was placed approximately one foot from the top of the HDPE to minimize wind and heat effects on the HPDE. Small slots were made in the base of the fence at regular intervals to allow smaller, less threatening species to access the site. The flashing and wood brace on the HDPE have been working very well.

Third, to eliminate the squirrel habitats for long-term effectiveness, engineering controls were implemented in the road berm and landfill drainage areas. Soil on the berms was covered with a 12-inch thick layer of cobbles averaging about 4 inches in diameter. After placement of the cobbles, voids were filled with a 1-to 2-inch layer of concrete/sand slurry. The new energy dissipators consist of a 6-inch layer of 4-inch diameter cobbles, 4 inches of concrete/sand slurry, and a layer of 12-inch diameter cobbles embedded into the slurry layer.

As a result of these measures, squirrels are now seldom seen at the Site 1 Landfill, and only sporadically do a couple of shallow burrows require filling, thus decreasing significantly long-term O&M costs.

Well Replacement Ensures Quality Data

Quarterly post-closure groundwater sampling at the Site 1 Landfill began in July 1999. The quality of a post-closure monitoring program depends on the adequacy and integrity of the groundwater monitoring wells. Therefore, groundwater monitoring wells are inspected routinely, and groundwater monitoring results are evaluated. Based on the inspections and water quality evaluation, several monitoring wells were identified with problems ranging from corrosion, resulting in a cascade of metal flakes into the well (unacceptable when sampling for metals), to a well that consistently showed questionable turbidity levels. Monitoring wells with such problems can compromise the integrity of the data, making interpretation and future decisions difficult. Groundwater flow direction also was evaluated, but evaluation of flow direction did not result in the need for modification of the monitoring well network.

The Navy team replaced problem wells that could have affected data quality.

Problem monitoring wells were decommissioned, and new wells were installed. Now in place is a groundwater monitoring network that is designed specifically for the site, based on the lithology and groundwater flow direction. These wells are optimal for evaluating groundwater conditions to protect the environment. Plus, long-term sampling labor and lab analysis costs are reduced because only quality data are collected.

Plans Simplify Transition

To help contractors responsible for post-closure care, the Navy developed a detailed Post-Closure Long-Term Monitoring Plan (LTMP) and Post-Closure Long-Term Maintenance Plan (LTMtP). The LTMP details groundwater and landfill gas sampling procedures and how to interpret the data in accordance with regulations. The LTMtP describes O&M activities such as drainage control and vegetation control; it also details how to evaluate and repair potential differential settlement. These documents will aid contractors in their transition to the site. Use of these plans will help ensure that future activities are technically sound and consistent (and therefore comparable) with historical activities.

Point of Contact

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New ITRC Documents Address Soil and Groundwater Remedies

The Interstate Technology and Regulatory Council (ITRC) recently released four technical guidance documents to the environmental community. ITRC documents are developed by multidisciplinary and consensus-based teams that receive input from States, Federal agencies, industry, academia, and citizen stakeholders.

Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater, 2nd Edition

This document prepared by ITRC's In Situ Chemical Oxidation Team is a thorough revision and expansion of the document first issued in 2001. It outlines the technical requirements of in situ chemical oxidation (ISCO), a group of technologies involving various combinations of oxidants and delivery techniques. The primary oxidants addressed are hydrogen peroxide, potassium and sodium permanganate, sodium persulfate, and ozone. The effectiveness of some of these oxidants can be enhanced through activation (Fenton's reagent, activated persulfate) and used in conjunction with other oxidants (perozone). This edition provides a more comprehensive discussion on chemical oxidants than the first, along with a more detailed presentation of some of the key concepts of remedial design. ISCO-2 is intended to expedite movement toward consensus on regulatory requirements through the ITRC concurrence process.

Characterization, Design, Construction, and Monitoring of Mitigation Wetlands

Prepared by the ITRC Mitigation Wetlands Team, this document offers a unique flow diagram that illustrates the decision points in the overall mitigation process: assessing original wetland functions; defining goals and objectives based on mitigation option selections; and designing, constructing, and monitoring mitigation wetlands. To promote the long-term sustainability of mitigation wetlands, this guidance provides developers, consultants, regulators, and communities with example checklists for evaluating and documenting habitat health and measuring other performance criteria of mitigation wetlands. This guidance is intended to identify and simplify the technical elements of sound characterizations, design, construction, and monitoring of wetlands mitigation projects.

Environmental Management at Operating Outdoor Small Arms Firing Range

This document prepared by the ITRC Small Arms Firing Range Team will assist range operators in developing, using, and monitoring environmental management plans at active outdoor small arms firing ranges. The central task in formulating an environmental management plan is the selection and implementation of effective and reliable pollution prevention and mitigation measures, otherwise referred to as "best management practices" (BMPs). Developed by a partnership among State and Federal environmental representatives, U.S. Department of Defense (DoD), shooting sports industry, and stakeholders this document focuses on providing range operators with the guidance they need to identify and undertake BMPs that are appropriate for and tailored to the site-specific environmental conditions at their ranges. It is a synthesis of several of the most used and tested guidance documents to date and builds on this information by adding experiences from case studies.

Overview of Groundwater Remediation Technologies for MTBE and TBA

Developed by ITRC's MTBE and Other Fuel Oxygenates team this document provides an overview of remediation technologies for methyl tert-butyl ether (MTBE) and tert-butyl alcohol (TBA) in groundwater. It is intended for readers who have a technical background, but not necessarily extensive remediation experience. This document describes several emerging technologies as well as established technologies that are used to remediate groundwater containing MTBE and TBA. Additionally, this document focuses on groundwater and does not address remediation of other media such as soil, air, or nonaqueous-phase liquid. When remediating groundwater, it is essential that sources of contamination, including impacted soil, be evaluated and controlled; otherwise, chemicals may continue to impact groundwater. Prompt responses to releases and source management are critical to minimizing total site remediation costs.

All of these documents are available on the ITRC web site at www.itrcweb.org. A link to this web site can be found on the NAVFAC Environmental Restoration & BRAC web site at http://enviro.nfesc.navy.mil/scripts/WebObjects.exe/erbweb. A limited number of hard copies are available. If you wish to receive a hard copy, please e-mail your request to itrc@wpi.biz.

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Enhanced Anaerobic Bioremediation Manual Developed

Introduction

Naval Facilities Engineering Command (NAVFAC), Air Force Center for Environmental Excellence (AFCEE), Army Corps of Engineers (USACE), and Environmental Security Technology Certification Program (ESTCP) have developed the tri-services *Principles and Practices or Enhanced Anaerobic Bioremediation of Chlorinated Solvents* manual, August 2004, to assist Department of Defense (DoD) restoration project managers (RPMs) and their contractors in determining whether the technology is appropriate for their sites, and to identify optimum approaches for implementing it to achieve remedial goals. The manual is available at http://www.afcee.brooks.af.mil/products/techtrans/bioremediation/BIOREMresources.asp and provides a "road map" for appropriate and successful implementation of enhanced bioremediation, while identifying "red flags" that may limit success.

Enhanced Anaerobic Bioremediation

Enhanced in situ anaerobic bioremediation involves the delivery of an organic substrate into the subsurface for the purpose of stimulating microbial growth and development, creating an anaerobic groundwater treatment zone, and generating hydrogen through fermentation reactions. This creates conditions conducive to anaerobic biodegradation of chlorinated solvents dissolved in groundwater. In some cases, organisms may need to be added, but only if the natural microbial population is incapable of performing the required transformations.

Enhanced in situ anaerobic bioremediation has emerged in recent years as a viable and cost-effective strategy for remediation of chlorinated solvents in groundwater. Advantages include complete mineralization of contaminants in situ with little impact on infrastructure, at a relatively low cost compared to more active, engineered remedial systems. However, the success of enhanced anaerobic bioremediation has not been universally demonstrated, and relatively few sites have achieved some form of closure or regulatory remedy decision to date. However, it is clear from the "success" stories described in the literature that the technology holds great promise when properly applied.

Principles and Practices Manual

The Principles and Practices or Enhanced Anaerobic Bioremediation of Chlorinated Solvents manual is essentially divided into three parts, including an overview of enhanced in situ anaerobic bioremediation (Section 1), a description of the science and principles of anaerobic bioremediation (Section 2), and the steps required to practice and evaluate the technology (Sections 3 through 6).

Once it has been determined that enhanced bioremediation is suitable for application at a site, the manual provides further guidance on the design of appropriate enhanced bioremediation system configurations and selection of the appropriate substrate for application. Several tools, and the rationale for when to use them are described within the manual. A supplemental Excel™ based cost estimating tool suitable for screening various configurations of implementing enhanced bioremediations, and instructions for using the tool has also been developed and is available at the following link:
http://www.afcee.brooks.af.mil/products/techtrans/bioremediation/BIOREMCost.asp.

Point of Contact

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Technology Transfer (T2) News

Visit Our Web Site Address: www.ert2.org

New ITRC Guidance on Permeable Reactive Barrier Applications

NAVFAC and the Alternative Restoration Technology Team (ARTT) work closely to foster partnerships with outside groups such as the Interstate Technology Regulatory Council (ITRC) to support effective regulatory interactions. As part of these efforts, NAVFAC participated in the completion of a new document titled *Permeable Reactive Barriers: Lessons Learned/New Directions* released in February of 2005.

The document summarizes key information and data on permeable reactive barriers (PRBs) gathered over the past ten years of technology development for both iron-based and other reactive media types. Zero-valent iron is the most common media used in PRBs to treat a variety of chlorinated organics, metals, and radionuclides. Other reactive media types discussed include compost, limestone, granular activated carbon, and zeolites for the treatment of metals and some organic compounds in groundwater.

The document provides a conceptual framework for site characterization, design, construction, and performance monitoring of PRBs. All regulatory permits necessary for PRB installation are identified, along with some State specific permit information. Common regulatory concerns are also addressed such as the need for institutional controls, evaluation of downgradient water quality, identification of reactive media impurities, and other issues. The document also provides cost comparisons to other treatment technologies, site-specific site profile information, and a discussion of lessons learned and challenges for future research. This document can be viewed at the following link: https://weborcl8.wpi.biz/itrc/WebFiles/PRB-4.pdf.

US EPA Issues Revised Draft of Contaminated Sediment Remediation Guidance for Hazardous Waste Sites

In February 2005, the U.S. Environmental Protection Agency's (EPA's) Office of Superfund Remediation and Technology Innovation conducted a peer review of its *Draft Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* with a panel of independent experts. The draft document incorporated comments received from almost 50 parties during the public comment period, including industry, States, other Federal agencies, environmental groups, and the public.

Use of this guidance may also be useful to Remedial Project Managers (RPMs) that are conducting a sediment cleanup under Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), or other environmental statutes, such as the Clean Water Act (CWA). The guidance summarizes issues to consider during remedial investigations and feasibility studies at sediment sites. It includes a discussion of the three major remedies for sediment management including monitored natural recovery, in situ capping, and dredging/excavation. The guidance then presents information on remedy selection for sediments and on monitoring at sediment sites. The revised document is now available at the following link: http://www.epa.gov/superfund/resources/sediment/guidance.htm.

Point of Contact

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Civil Engineer Corps Officers School (CECOS) Summer 2005 Restoration Training Schedule

July 2005

26~28	Environmental Negotiation Workshop	Aberdeen Pro, MD

August 2005

16~18	Navy Environmental Restoration Program	San Diego, CA

For registration and course information, visit CECOS web site: https://www.cecos.navy.mil.

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